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ggg **REPORT OF THE ACCIDENT TO MIL HELICOPTER MI8-P NEAR RANGALI, ARI ATOLL ON
26TH JANUARY 1999**

INTRODUCTION

Maldives is a signatory to the Convention on International Civil Aviation (Chicago 1944), which established the International Civil Aviation Organization. Article 26 of the Chicago Convention obligates the governments of countries that are signatory to the Convention to conduct investigations into aircraft accidents in their territories which involve aircraft of other countries which are signatories to the Convention.

In conducting the accident investigation the fundamental objective of the investigation is the prevention of aircraft accidents and incidents.

It is not the purpose of this activity to apportion blame or liability. The sole purpose of the exercise is the maintenance and enhancement of flight safety.

SYNOPSIS

On Saturday 26th January 1999, at about 21:30 LT, Mil Helicopter Mi-8P helicopter, LZ-CAK two minutes after take off from Rangali Helipad, lost its left engine. The helicopter took off into wind as normally (that is out from the Rangali Finolhu – and towards the sunset bar on Rangali Main Island). It was a normal climb and all the parameters were normal increasing the speed. Sparks were observed with a sudden loud noise at an altitude of 50m. The captain presumed that it was from the engine and he checked all the engine parameters including the second parameters. The captain checked and noted that all the parameters were normal and he instructed the co-pilot to monitor and double-check the parameters. The captain had the controls and he took a left turn to go around the main Rangali Island and make a safe landing on the helipad. The captain flew around the Rangali Island until he passed the last light (that was visible) and turned to return to the helipad. During this time one of the fire extinguisher bottles got discharged automatically and the caution light came ON – "Engine Fire Warning". The helicopter started to descent and passed over the bridge. He crossed over the bridge at a height of 15 meters above the bridge (the bridge connecting the two islands). At this point in time the captain had doubts if he could reach the helipad which was only 30 meters away. The helicopter was low and he did not have sufficient air speed to reach the helipad. The helicopter touched the water at about 7-8 meters from beach line and some of the passengers jumped out of the passenger door, which was already opened by the cabin crew. The cabin crew positioned at the main door was pushed away and more passengers egressed. The captain could not control the helicopter as the nose hit the water and windows were broken. The helicopter sank only about 6-7 meters away from shoreline.

The captain cut off the fuel when it sank and he checked the cabin and quickly escaped through the cockpit door. The captain said that he did not see any passengers in the cabin – however it was dark and would be impossible to find any thing underwater in the dark.

1. FACTUAL INFORMATION

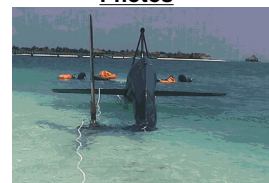
1.1 History of the flight

The helicopter, a twin engine Mil Mi8-P operated by Hummingbird Helicopters departed Rangali Helipad at about 2126 UTC with 17 tourists inbound for Male' International Airport. The flight was flown IFR and the weather condition was normal (no rain) and wind was at 6knots with no clouds.

The helicopter arrived from Maamigili Heliport to pick up the joining passengers from Rangali Resort. Immediately after landing at Rangali Helipad, the co-pilot did a walk around the helicopter while the engine was running. He stood at the tail rotor while the joining passengers boarded from Rangali Helipad. (It was normal practice that on short legs the passenger boarding is carried out by the cabin crew with the assistance of the Helicopter Landing Officers while the engine is running). The cabin crew and the Helicopter landing officer attended the passengers during boarding and baggage loading. Once all the passengers boarded, the co-pilot did an external visual inspection and boarded the helicopter. Neither the co-pilot nor the Helicopter landing officer observed any abnormalities.

The captain and the co-pilot conducted the pre-flight checks and the cabin crew did the safety briefing. The cabin crew showed the location of the emergency exits, the location of the life jackets and the safety-briefing card. Once the safety briefing was completed, the captain increased the power and lifted the helicopter and turned into wind. Once it lifted off it continued to climb toward the sunset bar in the Rangali Main Island.

Photos



Wreckage in water



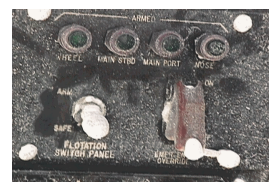
Helicopter crashed on the south-eastern side of Rangali Finolhu



Damage to the aircraft



Wreckage on land



Floatation switch in the SAFE position (Not Armed)



Floats inflated by hot-wire test



Thirty seconds after take off a sudden loud noise was heard during the climb; while the helicopter was mid way between the Helipad and Sunset Bar. (The Tourist and other staff in Rangali Island heard the noise and some had seen the flames from the left engine).



Evidence of engine oil leak on the helipad

The captain checked all the engine parameters and found it was normal. He immediately decided to return to the helipad. He told the co-pilot to monitor the engine parameter and there was no response from him. The captain took a left turn and went around the Rangali main island to avoid the island. He did not realise that it was an engine failure. He continued straight along the island and took a turn to fly over the bridge when he passed the last light on the island. As he approached to fly over the bridge the radio altimeter alarm was activated (this alarm gets activated below 35 meters). At this point still the rpm of the engines were normal. The helicopter had descended low enough as planned for landing and just before passing the bridge, the fire bottle was discharged automatically – and the engine fire warning light came ON. The forward airspeed and the altitude were very low and it was only Six to Eight meters away from the helipad. The rpm of the main rotor gear box started to drop. The captain could not do an auto-rotation due to insufficient airspeed and altitude.

The passenger door was already open by the cabin crew and he held the passengers from coming out – until the helicopter was stabilised – to prevent any passengers from getting caught by the main rotor. However one or two passengers came out of the passenger door and the third person pushed the cabin crew away just before the helicopter started to sink.

When the cockpit windscreen was broken, the captain turn off the fuel and checked the cabin and escaped from the cockpit door.

1.2 Injuries to Persons

	Crew	Passengers	Other	Total
Fatal	Nil	4	Nil	4
Serious	Nil	Nil	Nil	0
Minor	3	13	Nil	16
None	Nil	Nil	Nil	0
TOTAL	3	17	Nil	20

1.3 Damage to Aircraft

The helicopter was damaged beyond repair as a result of impact on water and submersion in salt water for 7 days. The wreckage was recovered on 3rd February 1999.

1.4 Other Damage

No other damage was reported to persons on ground.

1.5 Personnel Information

1.5.1 Pilot Information

	Captain	Co-pilot
Sex	Male	Male
Age	46 years	47 years
Licence Category	ATPL	CPL
Medical Validity	1 st June 1999	9 th June 1999
Licence Validity	1 st June 1999	9 th June 1999
IFR Rating	12 th March 1991	
Proficiency Check	16 th August 1998	1 st December 1998
Last Simulator Check	25 th November 1998	21 st October 1998
Instructor on Mi-8	(12 th Jan. 85') 1390:10 hrs. -	
Total Hours	8599:32	2309:50
Total on type	8159:47 5:50	

1.5.2 Cabin Crew

The cabin attendant on board was a Maldivian male of 21 years age who had undergone a basic in-house training as cabin crew and had done the Air Law Exam. The cabin attendant had been issued with a crewmember Certificate. The cabin attendant had a 13-month valid certificate granted by the Operator. The cabin attendant had a valid medical certificate and was valid till 30th September 2000.

1.6 Aircraft Information

1.6.1 Significant particulars

Registration	LZ-CAK (Bulgarian Registered)
Manufacturer	Ministry of Aviation Industry USSR
Model	Mil Mi8-P
Serial Number	10316
Country of Manufacture	Russia (USSR)
Date of Manufacture	12 December 1980

Left Engine

Model	TB2-117Ar
Serial number	C97111145
TSN	634.14 Hrs
Date of Manufacture	02 April 1987
Engine type	GAS Turbine

Right Engine

Model	TB2-117Ar
Serial number	C90421202
TSN	64.29 Hrs
Date of Manufacture	30 November 1990
Engine type	GAS Turbine

Holder of aircraft Registration	Heli Air Services, Sofia Airport.
Certificate No.	1040 (Bulgarian)
Issued Date	18 th July 1994
Aircraft Operator	Hummingbird Helicopters (Maldives) Pvt
Certificate of Airworthiness	Issued by Bulgarian MOT
Certificate No.	1040 (Bulgarian)
Issued Date:	18 th July 1994
Last renewed	01 Aug 1999 and Valid till 31 Jan 1999

Duty Time and Flight Time of the Pilots

Captain

Flying Time:	2hrs 38 minutes
Duty Time:	6 hrs 30 minutes
Flying Time since (1 st of Jan)	43hrs 11 minutes
Duty Time since	(1 st of Jan) 113hrs 30 minutes

Co-pilot

Flying Time:	2hrs 58 minutes
Duty Time:	7 hrs
Flying Time since (1 st of Jan)	18hrs 34 minutes
Duty Time since (1 st of Jan)	46hrs 15 minutes

1.6.2 Insurance

The helicopter was insured for passenger legal liability and third party liability. This insurance was valid from 10 of July 1998 to 9th of July 1999.

1.6.3 Weight and Balance

Aircraft maximum take of weight (MTOW)	12,000kg
Passenger weight	1800 kg
Baggage weight	130kg

1.6.5 Additional data

Engines

Left:

Type	TB2-117Ar
Engine serial No.	C97111145
Time since new:	634.14hrs
100 Hrs check:	December 1998
Date of Manufacture:	2 nd April 1987

Right:

Type	TB2-117Ar
Engine Serial No	C90421202
Time since new	64.29hrs
100 Hrs check	December 1998
Date of Manufacture	30 th November 1990

Main Gear Box:

Type	BP-8A Serial No. 8521101
Time since new	6438.34Hrs
Time since overhaul	539.29Hrs
100Hrs check:	18 th December 1998
Date of manufacture:	October 1984

1.6.6 Floatation System

Left Nose

DRC no.	FT 23075 Iss.A
Serial No.	332681
Inspection Date:	March 1993

Right Nose

DRC no.	FT 23076 Iss. A
Serial No.	332680
Inspection Date:	March 1993

Right Wheel

DRC no	FT 21797 Iss. C
Serial No.	328495
Inspection Date:	November 1992

Main Right

DRC no.	FT23074 Iss. C
Serial No.	331452
Inspection Date:	January 1993

Main Left

DRC no.	FT 21799 WH Iss. D
Serial no.	328507
Inspection Date:	October 1992

1.7 Meteorological Information

The Meteorological report at the accident site was unavailable. However the Met report from Male' International Airport is as follows (which is 64 Km away).

Date:	26 th January 1999
Time:	1700Z
Wind	020
Velocity	06 kts
VIS:	greater than 10Km
Clouds:	Few 1800 ft Towering Cu
Scattered Clouds:	28,000ft
QNH	101.2 atm
Weather:	No significant weather

1.8 Aids to Navigation

Not relevant to this accident.

1.9 Communications

The aircraft was under IFR although under advisory control of the Male' Tower within 20 miles of Male' International Airport VHF range. No contact was made with the tower prior to the accident.

1.10 Aerodrome Information

The last aerodrome of departure was Rangali, a licensed helipad of H2 category.

1.11 Flight Recorders

The helicopter was fitted with MC61 model CVR and SARPP-12 LM type FDR manufactured in Russia and commonly used on this type of helicopter.

The CVR, which was of a 'wire' type when removed from the helicopter from under the sea on the 27th January 1999, it was contaminated with salt water. The wire was also broken during removal of the tape and some part of the wire was lost and no recording of the day of the accident was found on the tape.

The FDR recovered from wreckage was taken to Sofia to the Bulgarian DCA. When the FDR was opened it was found that the film had been completely damaged. Hence no information was obtained from the FDR film.

1.12 Wreckage and Impact Information

The helicopter wreck was located under 5-6m of water in the lagoon. The wreckage was salvaged for investigation purpose on 3rd February 1999.

1.12.1 Helicopter and equipment

- The windscreen in the cockpit was damaged due to the impact. Belly of the helicopter had signs of deformation due to impact but this was minimal due to the integrity of manufacture.
- The CVR was recovered prior salvage of the wreckage and the recording relevant to the flight of accident was unavailable as the tape was damaged.
- All the lights on the caution panel were removed for further analysis (please refer section 1.17.1 of this report).
- Oil drain valve could not be further examined to obtain any useful information as it was fully corroded.
- All the pressure cylinders to the Flotation system had the pyrotechnic cartridge assembly intact and the gauges indicated full pressure – 3500 psi.
- The Flotation system activation switch was in the safe position – Not armed.
- The Flotation system override switch wire locked and the switch was not activated.
- The flotation system has back up power from the aircraft batteries – in the event of electrical power failure from the main engines.

1.13 Medical and pathological Information

A Medical Examination of the 5 dead passengers were conducted by a medical team from the Indhira Gandhi Memorial Hospital in the Maldives.

The crew and the surviving passengers suffered minor injuries.

According to the medical examinations carried out on the bodies it was revealed that the occupants sustained injuries which included the following:-

* blood stain area behind the ear

- * Multiple dilated bowel loops (x-ray)
- * Closed functions in the left metacarpal joint.
- * Bluish discoloration of face and neck and froth from mouth and nostrils.

It was noticed that Rigour Mortis was present. According to medical examination the probable cause of death was drowning.

1.14 Fire

Immediately after take-off, on the initial stage of climb, the left engine was on fire. The fire was due to overheating due to loss of engine oil. It was discovered in the investigation that the engine oil drain valve plug had failed. Evidence of oil leak was found on the helipad and on the wreckage underwater.

It was discovered from the technical records that the engine oil drain valve had not been removed for any maintenance. The valve has been fitted as delivered from the factory.

1.15 Floatation System

The helicopter was fitted with emergency floatation gear produced by FPT Industries/UK and the floatation system was type certified by MOT, Bulgaria to install on LZ-CAK (on 1st October 1994).

A total of six floats; two cylindrical (with hemispherical ends) and four spherical provides buoyancy for the emergency floatation. A loose diaphragm internally and equally divides the two cylindrical floats and each compartment has a non-return inlet valve.

The floats are located as follows and on activation the vessels are inflated by Nitrogen from the bottles.

- 2 pressure vessels for main floats
- 1 pressure vessel for both the wheel floats
- 1 pressure vessel for both nose floats.

1.15.1 Operation of Floatation System

The floatation system is activated by saline switches when immersed in water and works instantaneously. Two submersion actuators installed on the belly of the helicopter, when in contact with water. The floatation gear is designed to withstand a vertical descent velocity of 15 ft/sec and forward speed of 30 knots. This is well above the BCAR requirement of vertical speed of 5 ft/sec. There are 6 floatation vessels designed to inflate to neutral buoyancy in 3 to 4 seconds and fully inflate in 6 to 7 seconds.

1.5.2 Modes of Inflation

The floatation system is designed to activate automatically when in contact with water. However the floatation switch should be in armed position (Toggle switch) for automatic activation. It is included in the pilot's pre-flight checklist to arm the floatation system prior take-off. The SAFE/ARM switch initiate the Emergency Floatation System and it is a guarded type, utilising a sprung loaded sleeve on the lever of the switch that must be raised before the switch can be moved from Safe to ARM.

If the Automatic activation mode fails to operate, then a manual override is provided. Hence pilots could activate the floats by manual override and the electric connection for the manual override and automatic activation are independent and they have separate CBs.

Investigations revealed that none of the emergency floats were activated and the air bottles were intact. The pressure in the bottles was 3500 psi. Due to the impact the port float aft compartment was torn. But the rest of the floats were undamaged.

1.16 Emergency Services and Search and Rescue

As the accident occurred near the island and immediately after take off the emergency team was immediately dispatched from the resort. The divers and other staff were on the site fully equipped with

diving gear within 15 minutes.

The management of the island resort who immediately called the operator of the helicopter who in turn called Male' Air Traffic Control Center. The Air Traffic Center immediately alerted the Civil Aviation Department. The Coast Guard was also alerted.

1.17 Tests and Research

1.17.1 Bulb Analysis

1. Fire Warning MLG Cold OFF
2. Fire Warning Heater Cold OFF
3. Fire Warning RHS Engine Cold OFF
4. Fire Warning LHS engine Cold OFF
5. Fire Bottle – Manual Unpredictable -----
6. Discharge Valve Open Hot ON
7. Automatic Discharge Light Hot ON
8. Fuel Valve RH Engine Hot ON
9. Fuel Valve LH Engine Hot ON

1.17.2 Hot-wire Test of the Floatation System

The nose floats were "hot wired" and activated on 14th February 1999. The electric circuit was wired from the adapters in the Pressure Cylinder for the nose wheel floatation and the test was positive indicating that the pyrotechnic devices for the nose pressure cylinder functioned properly breaking the disc on the cylinder to discharge the gas into the floats although it is expired. The floats inflated instantaneously (fully deployed within 6 seconds) and no leaks or other discrepancies were found.

1.18 Additional Information

From the Site inspection it was noted that engine oil leak was observed on the helipad at Rangali and there was no oil leak marks on the helipad at Maamigili.

2. ANALYSIS

The presence of fire on the port side of the helicopter, confirmed by the eye witness accounts and the presence of oil stains on the helipad and the salvaged wreckage showed a loss of engine lubrication oil from the LHS engine. This showed that the LHS engine malfunctioned soon after take off from Rangali.

Examination of the wreckage confirmed the failure of the engine oil drain valve on the LHS, this meant that the engine lost all its lubrication oil and the engine failed due to over heating and causing the combustion chamber to rupture. The failure of the drain valve from the examination of the valve indicate a stress failure, possibly due to over tightening. The valve had broken in several pieces at the threading. However, further analysis of the valve was not possible owing to the corrosion on it when it was recovered with the wreckage more than a week after being submerged in the sea.

Although the loss of engine oil began just before the departure, as evident from the oil stains on the helipad, the captain did not realise that there was an engine failure until the engine fire warning came on as the fire bottle was discharged. The pilots realised there was a problem when they too heard the loud noise, when they decided to turn back and land on the helipad. The engine's secondary parameters, such as oil pressure and temperature gauges were on the co-pilot's side. However, in this incident the co-pilot was in a state of shock and panic and provided little or no help to the captain in providing information and assistance. Furthermore the co-pilot had not armed the floatation switch and also had not switched on the manual override of the floatation system.

By the time the captain realised that there was an engine failure, the helicopter was on its base leg and reduced altitude which meant that by then the helicopter could not make a single engine approach to the helipad or go into autorotation. Consequently the helicopter could not sustain the altitude and failed to make it to the helipad and crashed about 10-15 meters from the helipad into the sea.

As the helicopter crashed the cabin attendant had opened the main door to facilitate the egress of the passengers. However, as the main rotor was still running he remained at the doorway, but as the helicopter touched the water some of the passengers who rushed to the door pushed the cabin crew into the water. This meant there was nobody left in the cabin to assist the remaining passengers. In addition as the floatation system was not armed the system was not deployed. As a result as the helicopter crashed and the cockpit glass were broken and the main door which was open, let in water rapidly. This further impeded the egress of the passengers who had not been able to get out by then. By this time it was dark and there was no instruction to the passengers to don on their life jackets, except

that the helicopter had

developed an emergency and was returning to the helipad; none of the passengers had their life jackets on. Hence the passengers who did not get out were drowned.

CONCLUSIONS

1. Findings

1. The helicopter had been properly maintained and was considered airworthy.
2. The pilots were properly licensed.
3. The Captain attempted to reach the helipad.
4. The failure of the engine oil drain valve on the LHS meant that the engine lost all its lubrication oil and the engine failed due to over heating and causing the combustion chamber to rupture.
5. The loss of engine oil began just before departure, The crew were alerted to presence of fire on the LHS; but did not realise that LHS engine failed until the fire warning came indicating discharge of the fire bottle.
6. The crew did not brief the passengers adequately.

CAUSES

1. The loss of engine oil from the LHS engine meant that the engine lost all its lubrication oil and the engine failed due to over heating and causing the combustion chamber to rupture.
2. By the time the captain realised that there was an engine failure the helicopter was on its base leg and reduced altitude which meant that by then the helicopter could not make a single engine approach to the helipad or go into auto rotation. Therefore the helicopter could not maintain altitude and crashed into the water.

Contributing Factors

- i. The co-pilot did not check on the engine's secondary parameters and brief the Captain.
2. The emergency floatation System was not armed and thus reduced survivability.
3. Appropriate safety briefing was not given to passengers.

4- Safety Recommendations

It is recommended that to ensure safe operation of the type of the helicopter involved in the accident in the current operating environment, consideration be given to the following i.e.

- a. Greater co-ordination between pilots
2. Passengers be informed of the emergency.
3. Passengers be instructed to wear life jackets.

